

# Partnerships for Advanced Computational Infrastructure

## Program Solicitation

### Overview

NSF support of high performance computing has played a major role in advancing science and engineering research and in enabling U. S. world leadership in computational science and engineering. The NSF Supercomputer Centers program has served as a cornerstone of these advances by expanding the use of high-end computing in new disciplines, facilitating the acceptance of computation as a full partner in scientific research, and facilitating the education of a new generation of computational scientists and engineers in support of that shift.

This program solicitation for the Partnerships for Advanced Computational Infrastructure program, builds on and replaces the current NSF Supercomputer Centers program established in 1985, and focuses on taking advantage of newly emerging opportunities in high performance computing and communications. This new program will provide flexibility, both to adapt to rapidly evolving circumstances and to meet the need for high-end computation, in order to enable continued world leadership in computational science and engineering. The program will provide access for researchers to high performance computing systems as its core, with associated highly trained staff and researchers necessary to develop and optimize their use. The emergence of scalable parallel systems, high performance networking and high bandwidth, large capacity mass storage systems creates the opportunity for a national infrastructure consisting of a number of geographically distributed sites strongly coupled to high-end computational resources and to each other via high-speed communication networks.

NSF envisions an Advanced Computational Infrastructure consisting of one or more leading-edge sites together with cooperating partners. Leading-edge sites are expected to maintain high-end hardware systems that are one to two orders of magnitude more capable than those typically available at a major research university. These systems should be balanced in terms of processor speed, memory, and storage systems, and should be accompanied by appropriate staff, software and high speed communications capability. The partners will, in the aggregate, complete the overall infrastructure by, among other things, (a) facilitating research

and experimentation with new hardware and software, including appropriate support technologies such as visualization and mass storage, (b) providing scalable resources for applications and applications development that can be best done on mid-level systems, (c) providing access to unique experimental systems and facilities, and (d) promoting education and training.



## Background

Several reports analyzing the current Supercomputer Centers Program and making recommendations for future computational infrastructure have appeared recently. Most directly relevant to this solicitation is the [Report of the Task Force on the Future of the NSF Supercomputer Centers Program](#), chaired by Dr. Edward Hayes, September, 1995, which discusses the history, current context, and rationale for NSF support of high performance computational infrastructure for the science and engineering research communities.

Two other reports, [From Desktop to Teraflop: Exploiting the U.S. Lead in High Performance Computing](#), chaired by Dr. Lewis Branscomb, October, 1993, and [Evolving the High Performance Computing and Communications Initiative to Support the Nation's Information Infrastructure](#), chaired by Drs. Frederick Brooks and Ivan Sutherland, National Research Council, February, 1995 provide additional background and discuss the overall impact of these programs in the context of the larger, federally supported High Performance Computing and Communications program.

These reports are available on the [CISE homepage](#).

Hard copies of the first two reports may be obtained by sending e-mail to [Barbara Melvin](#). The NRC report is available from the National Research Council, 2101 Constitution Ave. N.W., Washington, DC 20418.



## Mission

As part of its strategic plan, NSF in a Changing World, a key NSF goal is to enable the United States to uphold a position of world leadership in science and engineering research and education. In order to maintain world leadership in computational science and engineering, NSF intends to create an advanced national computational infrastructure whose overall mission is to:

- provide, facilitate, and enhance access to high performance computational infrastructure for the U. S. academic, scientific, and engineering communities by partnering with universities, states, and the private sector;
- promote vigorous early use of experimental and emerging high performance computational and associated communications technologies that offer high potential for advancing science and engineering;
- enable the effective use of such infrastructure and technologies through education, training, consulting, and related support services, including appropriate software development, experimentation, and support;
- foster interdisciplinary research in science and engineering;
- facilitate the development of the intellectual capital required to maintain world leadership in computational science and engineering; and
- broaden the base for the nation's advanced computational and communications infrastructure.



## Purpose of this Solicitation

This solicitation calls for innovative proposals to provide a national computational infrastructure that will address the mission stated above. Guidance for participating in this solicitation is provided below.

Since the Partnerships for Advanced Computational Infrastructure Program will primarily support academic research, it is expected that proposals will come from, and the partnership's cooperative agreement will be with, a U. S. academic institution. However, a successful proposal must involve multiple partners who can be, but are not limited to:

- universities, including research groups within universities;
- NSF-funded Centers and facilities, such as, Science and Technology Centers, Supercomputer Centers, Engineering Research Centers, and Industry-University Cooperative Research Centers;

- research and educational consortia, organizations, and groups;
- regional and state-supported high-performance computing centers;
- private sector organizations; and
- national laboratories.

A full description of organizations and individuals who are eligible to submit proposals to NSF and the conditions under which they may compete, are given in the NSF Grant Proposal Guide (GPG) (NSF 95-27). Single copies of this brochure are available at no cost from the NSF Forms and Publications Unit, (703) 306-1130, or via e-mail: [pubs@nsf.gov](mailto:pubs@nsf.gov). Brochures are also available electronically through NSF's [Science and Technology Information System \(STIS\)](#).



## Review Process and Criteria

The review process will involve preproposals and full proposals, both of which will be reviewed by external panels using criteria discussed below. Panelists will be chosen from a variety of sectors including academia, the private sector, national laboratories, and other government agencies. Site visits are anticipated for finalists in the competition in order to clarify issues raised during the reviews, and to explore additional matters as needed. A summary panel, consisting of the chairs of the site visit teams and the chair of the final proposal review panel, will meet after the site visits to formulate final recommendations for a balanced program.

As with all proposals to NSF, these proposals will be evaluated using the four standard review criteria: (1) the quality of the proposed scientific effort, (2) competence of the investigators, (3) relevance of the research, and (4) impact on the infrastructure of science and engineering. However, for this particular solicitation, impact on infrastructure and competence of investigators will be especially important. Therefore preproposals and final proposals for this program will be subject to four, more specific, criteria dealing with the effectiveness of the overall partnership in addressing the program's mission, the quality of the individual partners, management, and financial leverage. While these more specific criteria are listed in priority order (with the first being the most important), **all** will be considered by the panels in arriving at recommendations. Finally, the summary panel will be asked to advise NSF on what each proposed partnership can contribute to the technical diversity and balance of the program as a whole. In assessing the degree to which each preproposal and proposal satisfies a particular

criterion, the reviewers will be asked to consider each of the following points.

1. The degree to which the proposed partnership addresses the overall mission statement and demonstrates that it will be able to:
  - provide the physical and human infrastructure needed to fulfill a national leadership role with an intellectual environment that can foster world leadership in computational science and engineering research across all NSF disciplines;
  - maintain balanced computational resources, including at least one site with capabilities one to two orders of magnitude greater than that typically available at a major research university;
  - enable interdisciplinary partnerships among the academic computer science, mathematics, and computational science research communities;
  - support and develop software enabling computational science and engineering;
  - effect outreach and technology transfer to a heterogeneous user base;
  - support cooperative relationships with hardware and software vendors;
  - foster the integration of research, education, and training in computational science and engineering;
  - promote the advancement of kindergarten through undergraduate science and engineering education generally; and
  - provide world-class leadership through a diverse and synergistic set of partners.
2. The degree to which the proposed individual partners demonstrate expertise in at least one of the following:
  - providing access to, and support for, high performance computing, including appropriate supporting technologies;
  - conducting world-class research in computational science and engineering, computer science and engineering, or an appropriate related field;
  - promoting vigorous early use of experimental and emerging scalable computing, communication, or mass storage technologies;
  - providing training, education, and outreach to the research and educational communities and to the private sector; and
  - supporting cooperative efforts across multiple intellectual and/or institutional sectors.
3. The quality of the proposed management of the partnership including:
  - clear plans for the close coordination and management of the partnership, including the computational, communications, and intellectual resources of the partners; and

- plans for measuring the partnership's success in meeting its goals.
- 4. The degree of financial leverage in the proposed program, including cost sharing. This can include personnel provided by institutions and vendors, state and local support, facilities, vendor discounts beyond normal educational discounts, software, etc.

**In addition, the final selection by NSF will consider what each partnership can contribute to the technical diversity and balance of the program as a whole.**



## **Funding Levels and Duration of Awards**

NSF funding for the current NSF Supercomputer Centers Program totals about \$65 million per year. Funding levels for the new program will depend on expected overall funding levels for NSF at the time of the award(s). NSF funding will enable active participation in the partnership and create a broad base supporting the national computational infrastructure for research in science and engineering. The number and size of awards will be based on the quality and potential impact of the proposed partnerships, and on the availability of funds. Each partnership will be funded through a single cooperative agreement specifying the level of support for each partner, as proposed by the partnership, and negotiated with NSF before the award. The cooperative agreement for the partnerships is expected to cover a five-year period beginning in fiscal year 1998.

Phase in of a new partnership is expected to occur over a one year period. Partnership plans and proposed budgets must be prepared with enough flexibility to allow the phasing in of partnership resources during the first year, as negotiated with NSF. To provide flexibility in meeting special needs, funding can be provided for partnerships having a membership that may change over the duration of the cooperative agreement; thus, proposals involving partners for a shorter period are encouraged, where appropriate. Funding will be provided in yearly increments subject to successful annual review of program plans, performance, and the availability of funds.

To provide a partnership with the flexibility to respond to an unusual opportunity, completion of a partner's task, changes or relocation of a critical person, etc., the partnership may propose (at any time, subject to review), a change in the number or composition of its partner sites. Normally such proposals will be part of the annual

program plan review process and would be considered along with other substantive issues.

The partnerships will be reviewed annually by an external partnership review panel, with site visits in the second year. In the fourth year of the program, NSF will conduct a full independent review of the overall program. Subject to the needs of the scientific and engineering community as determined by this review; the acceptable annual progress and performance reviews of the partnerships; and the availability of funds, NSF may invite renewal proposals, with the intent of extending successful partnerships for an additional five-year period.

At the end of ten years, this program will be "sunset". During the eighth year there will be a full and independent review to determine the anticipated future needs of the academic science and engineering community.



## Program Management

Each partnership will offer a variety of resources. In addition to computational resources, there might be visualization resources, such as access to a virtual reality environment, mass storage resources located at a single site, discipline-specific knowledge repositories, software development resources, code porting and optimization resources, discipline-specific subroutine and program libraries, performance instrumentation tools and libraries, generic subroutine libraries such as linear algebra codes, and educational and training resources.

The individual partnerships are being asked to propose management plans, allocation mechanisms, and means for obtaining external advice. However, NSF will require that the partnerships develop a single mechanism for allocation of the use of the bulk of the program's resources, independent of where they are located.



## Budget

Funds may be requested to support scientific and technical staff essential for

systems programming, software development, research and user services, coordination and conduct of education, training and outreach activities, and participant support; training materials and software; networking equipment and operating costs; and computer systems, indirect costs and other appropriate costs associated with the overall project. Proposers should itemize costs on the NSF Budget Form 1030 and include additional supporting documentation. Proposed cost sharing should be recorded on Line M of the Budget Form 1030.



## Cost Sharing

Cost sharing may be in cash or in-kind from any private or non-federal source. The estimated value of any in-kind contributions should be included and an explanation of the source, nature, amount, and availability of any proposed cost sharing should also be provided. Cost sharing must occur during the award period and must be consistent with OMB Circular A-110, Section .23. Cost sharing specified in the proposal will be referenced and included as a condition of the award.



## Preproposal Guidelines

In order to be eligible to submit a formal proposal, the institution must have submitted, by April 15, 1996, a preproposal that was reviewed, or been named as a partner on a preproposal that was reviewed. Preproposals will be reviewed by external panels using the criteria listed above. The intent of the preproposal round is to give the community an opportunity to put forth diverse ideas, provide information that will assist in developing a stronger proposal, and point out preproposals that are not expected to be competitive. Review comments from the preproposal round will be supplied about the middle of May 1996 to the proposers in order to provide feedback for the final proposal preparation. Multiple preproposals from the same proposing organization involving different partners, funding levels, and objectives are allowed. Neither institutional approvals nor signatures are required at this stage; however, proposals should follow any applicable institutional guidelines for preproposals.

Preproposals should be mailed to:

Partnerships in Advanced Computational Infrastructure  
NSF, Room 1122  
4201 Wilson Boulevard  
Arlington, VA 22230

Preproposals must be received by NSF no later than April 15, 1996; or postmarked no later than five (5) days prior to the deadline date; or sent via commercial overnight mail no later than two (2) days prior to the deadline date, to be considered for review.

Preproposals submitted in response to this solicitation must be prepared and submitted in accordance with the guidelines provided in the [NSF Grant Proposal Guide, \(GPG\) \(NSF 95-27\)](#); in particular, page formatting requirements given in [Chapter 2, Section C](#), will be strictly enforced and preproposals not complying will be returned without review. Preproposals should allow reviewers to address each of the evaluation criteria listed above.

Preproposals (15 copies) must include:

- A cover page listing the PI's e-mail address and FAX number, and all participating sites and organizations;
- An executive summary of 2-3 pages;
- A main body of 10 single-spaced pages, to include:
  - goals and objectives;
  - a description of the proposed partnership activities;
  - an overview of the partnership, its participants, and plans for closely coordinating the participants;
  - a staffing description and summary of the key personnel at each site;
  - a list of the expected accomplishments of the partnership over the five-year period of the award;
  - a proposed management plan for the partnership, including mechanisms for making policy and planning decisions, and obtaining advice from the community;
  - a proposed method for allocating and closely coordinating the computational and intellectual resources of the partnership; and
  - a plan for evaluating the success of the partnership.
- A description of proposed hardware, networking, and software, including planned upgrades;
- Key planned software and algorithm developments, if applicable;
- Cost sharing projections, both cash and in kind;

- A non-binding draft budget for each year (the proposed funding level for each partner should be specified);
- An appendix containing one to two page vita including the most relevant publications for the key personnel; and
- No additional appendices are allowed.

The preproposals will be reviewed by external panels. It is anticipated that preproposal review will be completed and feedback provided to the proposers by mid-May 1996.



## Proposal Guidelines

To be eligible to submit a formal proposal, the institution must have submitted a preproposal that was reviewed, or have been a partner on a preproposal that was reviewed.

Proposals should be mailed to:

Partnerships in Advanced Computational Infrastructure

NSF, Room 1122  
4201 Wilson Boulevard  
Arlington, VA 22230

Proposals must be received by NSF no later than September 1, 1996; or postmarked no later than five (5) days prior to the deadline date; or sent via commercial overnight mail no later than two (2) days prior to the deadline date, to be considered for review.

Proposals submitted in response to this solicitation must be prepared and submitted in accordance with the guidelines provided in the [NSF Grant Proposal Guide \(GPG\) \(NSF 95-27\)](#); in particular, page formatting requirements given on [page 3, Section C](#), will be strictly enforced and proposals not complying will be returned without review. Proposals should allow reviewers to address each evaluation criterion listed above.

Proposals (15 copies) should include the following:

- A cover page listing the PI's e-mail address and FAX number, and all participating sites and organizations;
- An executive summary of 2-3 pages;
- A main body of 40 single-spaced pages, to include:
  - goals and objectives;
  - a description of the proposed partnership activities;
  - an overview of the partnership, its participants, and plans for closely coordinating the participants;
  - a staffing description and summary of the key personnel at each site;
  - a list of the expected accomplishments of the partnership over the five-year period of the award;
  - a proposed management plan for the partnership including mechanisms for making policy and planning decisions, and obtaining advice from the community;
  - a proposed method for allocating and closely coordinating the computational, and intellectual resources of the partnership; and
  - a plan for evaluating the success of the partnership.
- A description of proposed hardware, networking, and software, including planned upgrades;
- Key planned software and algorithm developments, if applicable;
- Cost sharing proposed, both cash and in kind;
- A budget for each year (the proposed funding level for each partner should be specified);
- An appendix containing one to two page vita including the most relevant publications for the key personnel;
- An appendix containing letters that commit actual resources such as funds, hardware, people, space, etc. from the participating institutions, vendors, states, etc. and
- No additional appendices are allowed.

**Proposals will be reviewed by external panels. While there will be some overlap between the panels reviewing the preproposals and final proposals, the panelists will be instructed that any recommendations based on the preproposal review were not intended to be binding on the proposer. Recommendations and reviews from the preproposal round will not be available to the final proposal panel, and should not be considered in reviewing the final proposals. Site visits are anticipated for finalists in the competition in order to clarify issues raised during the reviews, and to explore additional matters as needed.**

Panel reviews are expected to be completed by October, 1996, and site visits will occur before the end of the 1996 calendar year. Awards should be announced in the

Spring of 1997.

Inquiries related to the program should be sent via e-mail to [PACI@nsf.gov](mailto:PACI@nsf.gov)

or they may be sent by US mail to:

Partnerships in Advanced Computational Infrastructure  
NSF, Room 1122  
4201 Wilson Boulevard  
Arlington, VA 22230



## General Information

The Foundation provides awards for research in the sciences and engineering. The awardee is wholly responsible for the conduct of such research and preparation of the results for publication. The Foundation, therefore, does not assume responsibility for the research findings or their interpretation.

The Foundation welcomes proposals from all qualified scientists and engineers and strongly encourages women, minorities, and persons with disabilities to compete fully in any of the research related programs described here.

In accordance with federal statutes, regulations, and NSF policies, no person on grounds of race, color, age, sex, national origin, or disability shall be excluded from participation in, be denied the benefits of, or be subject to discrimination under any program or activity receiving financial assistance from the National Science Foundation.

**Facilitation Awards for Scientists and Engineers with Disabilities (FASSED)** provide funding for special assistance or equipment to enable persons with disabilities (investigators and other staff, including student research assistants) to work on NSF projects. See the program announcement (NSF 91-54) or contact the program coordinator at 306-1636.

**Privacy Act and Public Burden.** The information requested on proposal forms is solicited under the authority of the National Science Foundation Act of 1950, as amended. It will be used in connection with the selection of qualified proposals and

may be disclosed to qualified reviewers and staff assistants as part of the review process; to applicant institutions/grantees to provide or obtain data regarding the application review process, award decisions, or the administration of awards; to government contractors experts, volunteers, and researchers as necessary to complete assigned work; and to other government agencies in order to coordinate programs. See Systems of Records, NSF 50, **Principal Investigators/Proposal File and Associated Records**, and NSF-51, 60 Federal Register 4449 (January 23, 1995), **Reviewer/Proposal File and Associated Records**, 59 Federal Register 8031 (February 17, 1994). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of your receiving an award.

Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Herman G. Fleming, Reports Clearance Officer, Contracts, Policy, and Oversight, National Science Foundation, 4201 Wilson Boulevard, Arlington, VA 22230.

The National Science Foundation has TDD and FIRS capability, which enables individuals with hearing impairment to communicate with the Foundation about NSF programs, employment, or general information. To access TDD dial (703) 306-0090; for FIRS, 1-800-877-8339.

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